

Serial No: 10/829,576
Examiner: S. YAM
Title: IMAGING APPARATUS

REMARKS/ARGUMENTS

Claim Rejections – 35 USC §102

Claims 1-3 and 5 are rejected under 35 U.S.C. §102(b) as being anticipated by Nakagishi et al. (US 2001/0010562). Applicants respectfully traverse this rejection.

Claim 1 requires a flexible printed circuit entirely covers a surface of the semiconductor imaging device opposite to a surface thereof facing the optical system and a region of the flexible printed circuit facing the semiconductor imaging device has sufficient shielding characteristics in a range sensitive to light reception by the semiconductor imaging device. In other words, the flexible printed circuit provides a sufficient shield against light entering from a surface (“back surface”) opposite to a light-receiving surface of a semiconductor imaging device. This is because a sensitive region of the semiconductor imaging device extends to a visible light range on both its sides.

Infrared light, for example, has a longer wavelength than visible light and does not attenuate very easily. It can enter the back surface of the semiconductor imaging device and reach the inside of the semiconductor imaging device (more accurately, a photodiode for converting light into an electric signal), thereby causing noises leading to image quality deterioration. Ultraviolet light, on the other hand, which has a shorter wavelength than visible light, attenuates easily and thus does not cause considerable noise.

On the side of the light-receiving surface of the semiconductor imaging device, a suitable optical filter (see e.g. “5” in Fig. 3) can be provided to limit the passage of infrared light. Light that has entered the side of the light-receiving surface of the semiconductor imaging device will then be only filtered light from a subject that is converted into a signal. In the invention of claim 1, undesired light such as infrared light is prevented from reaching the inside of the imaging device via the back surface because of the flexible printed circuit with shielding properties.

Nakagishi et al. neither discloses nor suggests light entering from the backside surface of a CCD image sensor. In fact, Nakagishi et al. discloses placing the CCD image sensor in a package, and therefore, has no concern about transmission through the

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backside of the CCD image sensor. Further, the flexible printed circuit 3 is provided with an opening 31 through which the wall portion 22 of the metal plate 2 passes. In that regard, the opening 31 always is present in a region facing the CCD 1 of the circuit 3 disposed on the backside surface of the CCD 1. Nakagishi et al. thus does not disclose the flexible printed circuit entirely covers a surface of the semiconductor imaging device opposite to a surface thereof facing the optical system, and a region of the flexible printed circuit facing the semiconductor imaging device has sufficient shielding characteristics in a range sensitive to light reception by the semiconductor imaging device as required by claim 1 of the present invention. For at least these reasons, claim 1 is patentable over Nakagishi et al.

Claim 2 requires a thinner imaging apparatus obtained by grinding its back surface. Image quality deterioration due to light entering from the back surface of the semiconductor imaging device is prevented via the shielding characteristics of claim 1, and therefore, the thinner device is practical. This feature is nowhere disclosed nor suggested by Nakagishi et al.

Claim 3 requires that in the region of the flexible printed circuit facing the semiconductor imaging device, the shielding characteristics against light with a wavelength longer than a visible range is higher than that against light in the visible range. Nakagishi et al. only teaches an infrared cutting filter provided above the flexible printed circuit. Nakagishi et al. therefore discloses cutting off infrared components from light entering the light receiving surface side of the CCD. The features of claim 3 are therefore neither disclosed nor suggested by Nakagishi et al.

Claim 5 depends from claim 4, which is not rejected as anticipated. Claim 5 is therefore not anticipated. Further, claim 5 requires the presence of metal foil containing aluminum as a main component. The metal foil reduces the weight of the imaging apparatus while simultaneously providing the flexible printed circuit with sufficient shielding characteristics. This feature is neither disclosed nor suggested by Nakagishi et al. For at least these reasons, claims 2, 3 and 5 are patentable over Nakagishi et al. Further, claims 2, 3 and 5 are patentable over Nakagishi et al. since they depend ultimately from parent claim 1.

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Claim Rejections – 35 USC §103

Claims 4 and 6 are rejected under 35 U.S.C. §103(a) as being unpatentable over Nakagishi et al. Applicants respectfully traverse this rejection.

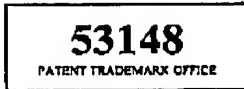
Regarding claim 4, the rejection asserts it is obvious to one of ordinary skill in the art to laminate two layers of material to increase rigidity. The claimed invention however is directed to a metal foil that is laminated on the flexible printed circuit disposed on the back surface side of the semiconductor imaging device to provide a sufficient shield against light entering from the back surface of the semiconductor imaging device in order to prevent image quality deterioration caused by an increase in noises. Nakagishi et al. neither discloses nor suggests such a feature. For at least these reasons, claim 4 is patentable over Nakagishi et al.

Regarding claim 6, the rejection asserts it is obvious to one of ordinary skill in the art to provide the metal foil containing silver or nickel as a main component, in the apparatus of Nakagishi et al., since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. The use of a metal foil formed of silver as required by claim 6 however, achieves an effect of improving EMI characteristics and immunity characteristics in a several GHz band used for cellular phones or the like or an effect of eliminating the need for any antirust treatment, while providing the flexible printed circuit with sufficient shielding characteristics such as discussed in association with one embodiment of the invention on lines 6-20 of page 11 of the specification. Further, a metal foil formed of nickel achieves an effect that, because of its ferromagnetism, nickel can serve as an electromagnetic shield so as to reduce the unwanted emission, while providing the flexible printed circuit with sufficient shielding characteristics such as discussed in association with one embodiment of the invention on lines 21-33 of page 11 of the specification. These features are neither disclosed nor suggested by Nakagishi et al. The rejection interprets the teachings of Nakagishi et al. in light of Applicant's own disclosure, and therefore reflects an improper use of hindsight in finding the invention of claim 6 unpatentable. The rejection should be withdrawn.

For at least these reasons, claims 4 and 6 are patentable over Nakagishi et al.

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Favorable reconsideration in the form of a Notice of Allowance is requested. If the Examiner believes a telephone conference would advance the prosecution of this application, the Examiner is invited to telephone the undersigned at the below-listed telephone number.



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Respectfully submitted,

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